Developing Use Cases from the Various User Communities for Decadal Survey Mission Products

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Why Are We Here?

- Why are we here?
  - To better understand the needs of the various users of Decadal Survey measurements and resulting data and model products
  - *Highlight challenges to meeting the recommendations of the Decadal Survey*
  - Establish lines of communication with DS teams for evolution of *mission* and data operations concepts that affect the end users
  - Capture highlights of key use cases
- What's in it for you?
  - Better serve all user communities
  - Identify Decadal Survey needs and technology gaps
  - Address needs/gaps in future proposal calls (AIST, etc.)

Use Cases from User Communities

- Potential User Communities:
  - Science Team
  - Cal/Val Scientists
  - Multi-Sensor Domain Scientists
  - Cross-Domain (multi-disciplinary) Scientists
  - Modeling Community
  - Decision Support / Applications
  - Public Users / Education & Outreach
- Develop Use Cases (a procedure for today)
  - Identify a User Community and Need
  - Develop a Use Case (short narrative describing how user does some activity)
  - Identify implied challenges on the data systems

Key Questions for each Use Case

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  - How do you plan to do what you need to do?
  - Are you leveraging an existing solution or software?
  - What is the hardest part?
  - Do you have any ideas about how to make it easier?
  - Do you have lessons learned from the past?
  - How could a new technology help?

DESDynI-L Use Cases

Discussion with DESDynI Lidar team and users

1. Use Case: Filter data with pre-defined quality settings
2. Use Case: Annotate data products
3. Use Case: Update products
4. Use Case: Make prototype data products for validation
5. Use Case: Fuse data
6. Use Case: Find and subset data in a space-time region
7. Use Case: Infuse high performance computing technology into operational production
8. Use Case: Access field and aircraft data
9. Use Case: Execute customized processing
10. Use Case: Conduct peer review of data products
11. Use Case: Document data in a common format
12. Use Case: Produce regional time series of data
13. Use Case: Find satellite crossover matchups
14. Use Case: Process Level 1 data for non-standard products

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http://tiwg.wik.is/Use_Cases

Example Use Case

	User Community: Science Team
Use Case Name	**Annotate data products**
Point of contact	Scott Luthcke
Goal	Annotate data products to show the level of validation and product quality.
Summary of the scenario	1. With the progression of the mission, accumulation of data and improvement of algorithms, the science team acquires a more thorough knowledge of data artifacts and overall accuracy. 2. On discovery of an artifact or product validation or quality issue, the science team member adds an annotation to the data product at large, a certain subset of the product or even an individual file. The subset may be files in a certain spatial area (e.g., Sahara Desert) or under certain conditions (blowing snow detected). 3. The annotation is attached to (or inserted into) the data files. 4. End users acquiring the data that are annotated will receive the annotations as well. These may be hyperlinks to stable documents on the web or attributes added to the file. 5. End users that have already acquired the affected data files and have signed up for updates (or not opted out for updates?) will automatically get a notice about (or including) the annotation and/or a way to obtain the annotation.
Users (actors)	Science team member: annnotates the data product End User: downloads the data product
Key systems involved	The Data Archive and Distribution system maintains the link between data and the annotation.
Notes	

Science Team

- Science Team for mission (concerned with):
  - Science algorithms
  - Production system for L1/L2/L3 products (versioned software)
  - Retrieval robustness, consistency, & accuracy
  - Peer-reviewed publications
- Sample Requirements
  - Reprocessing of entire mission time-series, multiple times
  - Detailed quality control & product stratification for science analysis
  - Cal/val for campaign periods
- Sample Use Cases
  - Cost effective and fast-throughput reprocessing campaigns (can Cloud Computing help here?)
  - Stratify retrieval accuracy analysis by a physical parameter from another instrument (e.g. cloud scene classification)
  - [Yours here.]

Cal/Val Scientists

- Cal/Val Scientists:
  - Internal to science team
  - External cal/val scientists (or multi-sensor scientists)
  - External data and data inter-comparisons
- Sample Requirements
  - Science team develops operational cal/val products
  - External users need multi-instrument or instrument-to-model-grid matchups
  - Need space/time query on products and clear, documented quality control flags
- Sample Use Cases
  - Pre-compute two-instrument matchups & first “merged” data product for cal/val analysis
  - External cal/val teams use matchups to create custom merged data product and refined cal/val analysis
  - [Yours here.]

Multi-Sensor Domain Scientists

- Multi-Sensor Scientists:
  - Scientists that understand the domain
  - Can deal with instrument-specific physical variable names
  - But need help with understanding quality control: e.g. accuracy of retrieval for different geophysical regimes
- Sample Requirements
  - Need space/time query on products and clear, documented quality control flags
  - Need multi-instrument or instrument-to-model-grid matchups
- Sample Use Cases
  - Compare retrievals from a new instrument to an existing instrument over entire overlapping time period
  - Fuse data from two or more different instruments
  - [Yours here.]

Cross-Domain Scientists

- Cross-Domain Scientists:
  - Scientists that don't understand details of domain
  - Need generic/helpful variable names
  - Need pre-selected quality control levels
- Sample Requirements
  - Locate & access L2 retrievals by "Googling" for a generic variable name, e.g. aerosol optical depth
  - Data system should automatically provide several quality control options or "best" data
- Sample Use Cases
  - An atmospheric chemistry scientist seeking ground deformation data associated with volcanic erruption
  - [Yours here.]

Modeling Community

- Modeling Community:
  - Modelers who assimilate data
  - Climate modelers who must do large-scale comparisons of L2/L3 measurements to models for model validation
  - Complex system modelers who use data as inputs to drive models
  - OSSE modelers and data assimilation modelers must develop sophisticated observation operator to model instrument retrieval
- Sample Requirements
  - Need automated interfaces, pre-selected measurement quality control, large-scale operations
  - Use only special, high-quality observations in comparisons
  - Simultaneously validate an ensemble of models
- Sample Use Cases
  - Compare L2 observations of aerosol optical depth to predictions from IMPACT and regional aerosol models
  - [Yours here.]

Decision Support / Applications

- Decision Support / Applications:
  - Policy makers, first responders, application researchers
  - Often supported by models and automated Decision Support Systems
  - Value low latency over highest quality
- Sample Requirements
  - Need turn-key, high-level products generated in near real-time
  - Need automated interfaces with guaranteed levels of service
  - May require customized product to satisfy application needs
  - Direct downlink
  - Post Level-4 products: actionable, quantitative metric computed from geophysical L3/L4 data
- Use Cases
  - Send alerts to NOAA Satellite Branch when volcanic SO2 is detected
  - [Yours here.]

Public Users / Education

- Public Users / Education:
  - Citizen scientists, K-12/undergrads, museum goers/iPhone apps
  - Educational science stories, with pictures & movies
  - Built-in visualization is key
  - Must have simplified, directly interpretable products (atmospheric temperature or snow depth, not radiance)
- Sample Requirements
  - Need to be able to access products in mass-market tools (Google Earth/Maps or NASA World Wind, iPhone)
  - Need accessible science stories with “exciting” movies
- Sample Use Cases
  - High-school lab assignment
  - NASA Earth Observatory
  - [Yours here.]

Background

- NASA Earth Science Data System Evolution Needs from the June 2009 Decadal Survey Era Data Systems Workshop
- Scope of Decadal Survey Era Data Systems
- NASA Programs for Technology and Infusion Opportunities
- Scope of ESTO Advanced Information Systems Technology (AIST) Program

NASA Earth Science Data Systems Evolution Needs

- Define an approach to evolve [from] what is working now into what we want to have in 2020 and beyond
- Keep what works within the existing systems, and identify what must be changed
- Consider how best to identify and involve the end user communities in the data system and product definition
- Define a recommended approach for guiding the new missions' data system definition and development
- Identify necessary actions and activities for the near term (0-2 years) that supports these developments

Scope

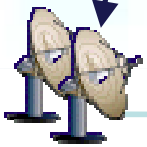
On Board Processing

Science Teams

Outreach

Research

TDRS Network



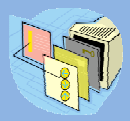
Data Acquisition and Command

Mission Operations

Instrument Operations

L0A Processing

EDOS/Ground Data Systems

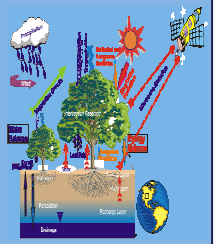


Science Data Processing
L0B
L1
L2
L3
L4

Science Data Systems

Science Data Management Archive & Distribution

EOSDIS Data Centers



Analysis Modeling & Data Assimilation

Distributed Data Analysis

Applications

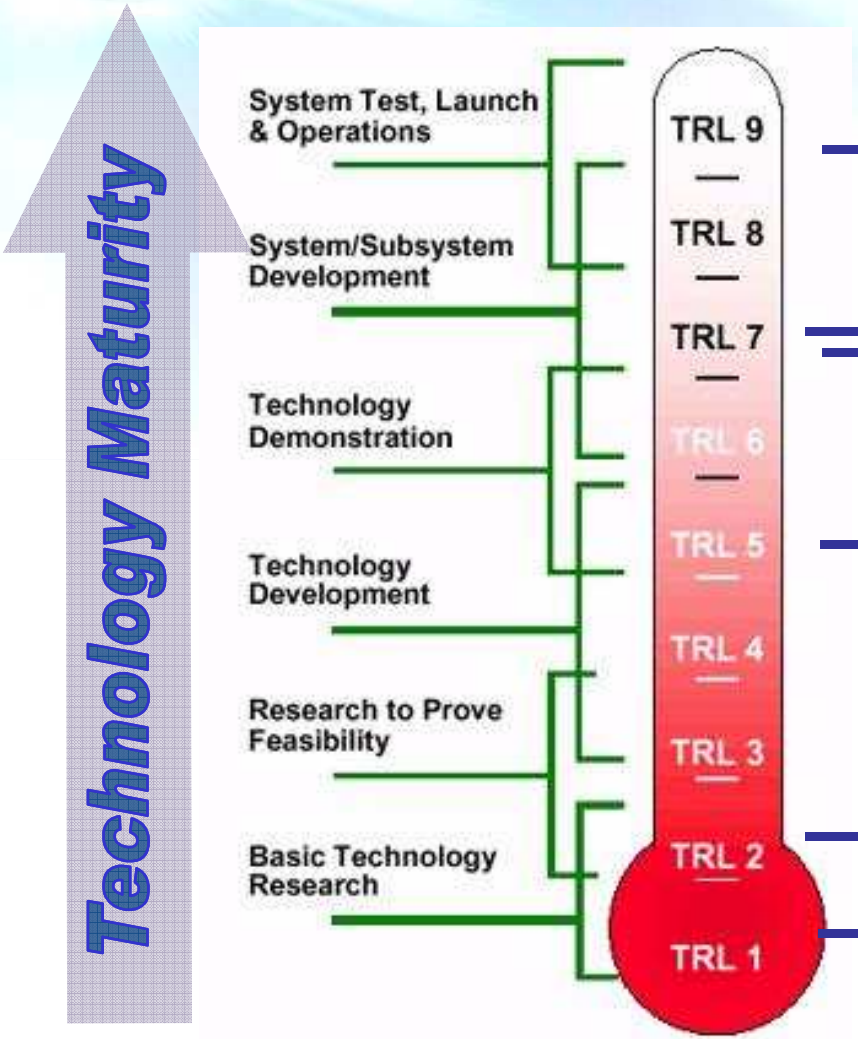
Decision Support

Other Data Systems (e.g. NOAA)

NASA ROSES Programs for Data Systems Research

- NASA's Earth Science approach for continually evolving data systems is through a competitive NASA Research Announcement (NRA) entitled "Research Opportunities in Space and Earth Science (ROSES)"
- ROSES contains many program elements, but technology infusion into Earth science data systems generally involves the leveraging existing technologies and methodologies and maturing them through one or more these elements (depending upon the starting TRL):
  - Applied Information Systems Research (AISR)
  - Advanced Information Systems Technology (AIST)
  - Advancing Collaborative Connections for Earth System Science (ACCESS)
- These programs are centered on technologies and methodologies that serve the Earth science research and applied science communities.

Role of NASA Programs in Technology Infusion



TRL = Technology Readiness Level

ESTO TRL Assessment Tool

ACCESS

Leveraging

AIST

Existing

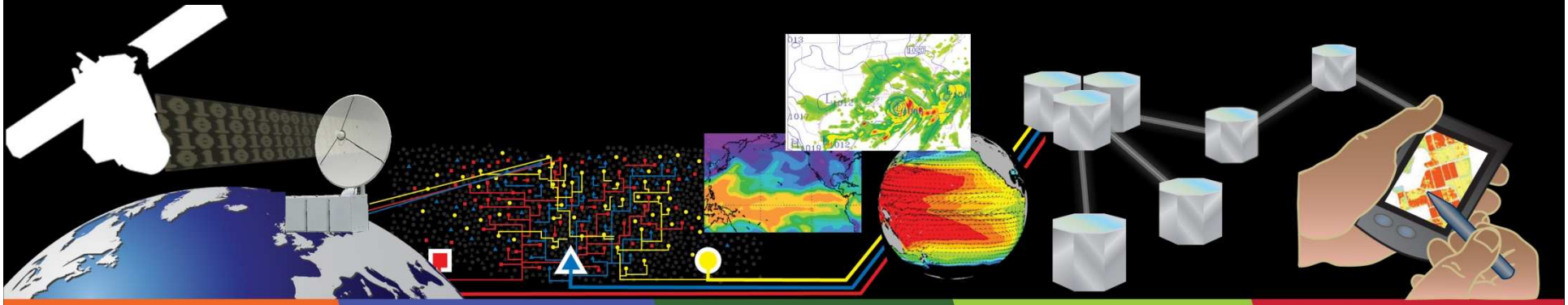
AISR

Technologies

Infusion

ES Data Systems

Advanced Information Systems Technology – AIST



Data Collection & Handling | Transmission & Dissemination | Data & Information Production | System Management | Search, Access, Analysis & Display

AIST technologies are providing increased access to, and improved interrogation of, Earth science data through services designed for a wide range of users.

AIST technologies are managing remote sensing resources and data in order to create fully interoperable systems and provide feedback loops for new, improved observations.

AIST technologies are creating new ways to improve, visualize, combine, extract and understand complex and ever-expanding Earth science data returns.

AIST technologies are ensuring rapid, robust, error-free data transfer and exchange across and among disparate space- and ground-based systems.

AIST technologies are helping make observations more useful, more autonomous, more timely, and more efficient while also preserving the lifetimes (cost) of valuable instruments and sensors.

Use Case Form

	User Community:
Use Case Name	
Point of contact	
Goal	
Summary of the scenario	
Users (actors)	
Key systems involved	
Notes	